WHAT IS CLAIMED IS:

1. An isolated nucleic acid comprising a polynucleotide sequence encoding a vanadium haloperoxidase polypeptide consisting of a catalytic helical frame that complexes a vanadium ion and catalyzes the oxidation of o-dianisidine (ODA).

2. The isolated nucleic acid of claim 1, wherein the polypeptide comprises an Ala residue at a position corresponding to position 455 of SEQ ID NO: 2, a Cys residue at a position corresponding to position 457 of SEQ ID NO: 2, or a Val residue at position 525 of SEQ ID NO: 2.

3. The isolated nucleic acid of claim 1, wherein the vanadium haloperoxidase polypeptide comprises an amino acid sequence having at least 70% amino acid sequence identity to an amino acid sequence from residue 435 to residue 632 as set forth in SEQ ID NO:2.

4. The isolated nucleic acid of claim 3, wherein the polynucleotide sequence has at least 70% sequence identity to a subsequence as of SEQ ID NO:1.

5. The isolated nucleic acid of claim 3, wherein the polypeptide has at least 80% identity to residue 435 to residue 632 as set forth in SEQ ID NO:2.

6. The isolated nucleic acid of claim 3, wherein the amino acid sequence is residue 435 to residue 632 of SEQ ID NO:2.

7. The isolated nucleic acid of claim 3, wherein the polypeptide has a molecular weight of about 20 kDa.

8. The isolated nucleic acid of claim 3, wherein the polynucleotide sequence is operably linked to a promoter sequence.

9. An expression cassette comprising a heterologous promoter operably linked to the polynucleotide sequence of claim 1.

10. The expression cassette of claim 9, wherein the nucleic acid has at least 70% sequence identity to a subsequence of SEQ ID NO:1.

11. The expression cassette of claim 9, wherein the polypeptide has at least 80% identity to a polypeptide as set forth in SEQ ID NO:2.

12. The expression cassette of claim 11, wherein the amino acid sequence is residue 435 to residue 632 of SEQ ID NO:2.

13. A cell comprising the expression cassette of claim 9.

14. An isolated polypeptide comprising vanadium haloperoxidase polypeptide consisting of a catalytic helical frame that complexes a vanadium ion and catalyzes the oxidation of o-dianisidine (ODA).

15. The isolated polypeptide of claim 14, wherein the polypeptide comprises an Ala residue at a position corresponding to position 455 of SEQ ID NO: 2, a Cys residue at a position corresponding to position 457 of SEQ ID NO: 2, and a Val residue at position 525 of SEQ ID NO: 2.

16. The isolated polypeptide of claim 14, having an amino acid sequence having at least 70% amino acid sequence identity to a sequence from residue 435 to residue 632 of SEQ ID NO:2, wherein the polypeptide catalyzes oxidation of o-dianisidine (ODA) when complexed with a vanadium ion.

17. The isolated polypeptide of claim 16, the polypeptide has at least 80% identity to a polypeptide as set forth in SEQ ID NO:2.

18. The isolated polypeptide of claim 16, wherein the amino acid sequence is residue 435 to residue 632 of SEQ ID NO:2..

19. The isolated polypeptide of claim 16, wherein the polypeptide has a molecular weight of about 20 kDa.

20. The isolated polypeptide of claim 16, wherein the polypeptide is immobilized on a solid surface.

21. The isolated polypeptide of claim 16, wherein the polypeptide further comprises a cleavable linker sequence.

22. The isolated polypeptide of claim 21, wherein the cleavable linker sequence is an enterokinase cleavable linker sequence.

23. The isolated polypeptide of claim 16, wherein the polypeptide further comprises an purification tag.

24. The isolated polypeptide of claim 23, wherein the purification tag comprises a plurality of histidine residues.

25. A method for enzymatically halogenating a compound, the method comprising contacting the compound with an isolated polypeptide of claim 14.

26. The method of claim 25, wherein the compound is a protein.

27. A method for enzymatically oxidizing a compound, the method comprising contacting the compound with an isolated polypeptide of claim 16.

28. A method preparing an active vanadium haloperoxidase polypeptide, the method comprising:

culturing recombinant bacterial cells comprising an expression cassette encoding the vanadium haloperoxidase polypeptide under condition suitable for the expression of the vanadium haloperoxidase polypeptide;

isolating inclusion bodies from the bacterial cells;

solubilizing the vanadium haloperoxidase polypeptide in alkali at pH 10-12; and

refolding the vanadium haloperoxidase polypeptide, thereby producing an active vanadium haloperoxidase polypeptide.

29. The method of claim 28, wherein the expression cassette comprises a heterologous promoter operably linked to the polynucleotide sequence of claim 1.

30. The method of claim 28, wherein the step of refolding comprises contacting the vanadium haloperoxidase polypeptide with an ammonium sulfate solution.

31. The method of claim 30, wherein the step of refolding is carried out at room temperature.

32. The method of claim 30, wherein the ammonium sulfate solution further comprises magnesium sulfate.

33. The method of claim 28, wherein the step of refolding comprises contacting the vanadium haloperoxidase polypeptide with magnesium sulfate.

34. The method of claim 33, wherein the step of refolding is carried out at about 0°C to about 10°C.

35. The method of claim 28, wherein the step of refolding comprises contacting the vanadium haloperoxidase polypeptide with the vanadium haloperoxidase polypeptide with imidazole and sodium or potassium chloride.

36. The method of claim 33, wherein the step of refolding is carried out at about 10°C to about 17°C.